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ABSTRACT

This paper reports the results of two related studies. The primary purpose of the first study (involving both nursery and first grade subjects) was to determine what evidence there is of two distinct processes basic to the control over the initiation and inhibition of inappropriate behavior on the Luria task. In the second study the focus of interest was in the relationship between impulsive behavior and the child's success with the academic work presented in the first grade. Other than the fact that the interstimulus interval in the Luria task was shortened to increase the difficulty level to one more appropriate for the first graders, the inclusion of indices of school learning constituted the only departure from the procedure used in the first study. Hence the results of study two permit an important check on the reliability of the initial findings. The data were consistent in indicating that distinct impulse control problems on the Luria task persist longer in the development of the lower SES child than the child of middle SES. The evidence consistently indicated that impulsive behavior is a more general phenomenon in the lower SES than in the middle SES. There is also reason to believe that this general control problem, in the lower SES, was related to the sorts of impulsive behavior observed by their teachers in the classroom. When intelligence was controlled, lower SES subjects obtained significantly poorer relationship between Luria task impulsively and grades in the middle SES. (Author/JM)

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FACTORS IN THE VERBAL CONTROL OF BEHAVIOR BY LOWER AND MIDDLE SES CHILDREN

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ABSTRACT

Impulsive behavior on a Luria-type task was examined for 165 middle and lower socio-economic status (SES) children in nursery school and first grade. Specific impulse control problems were found for both middle and lower SES children in nursery school. By first grade, only the lower SES children continued to exhibit this pattern. In the lower SES, Ss with difficulties in the verbal control of impulsive behavior were found to have lower grades and achievement scores even when IQ was held constant.

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FACTORS IN THE VERBAL CONTROL OF BEHAVIOR BY LOWER AND MIDDLE SES CHILDREN

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The problem of impulse control has been stressed in a number of intervention programs (see e.g. Klaus and Gray, 1968; Hertiz, Birch, Thomas and Mendez, 1968; Hooper and Marshall, 1968). On the other hand there is little systematic evidence indicating that children from lower socioeconomic status (SES) backgrounds are particularly prone towards impulsive behavior. Nor is there clear evidence that such a control problem contributes to lower SES childrens difficulties in the classroom. Luria's research (1961, 1965) on the verbal regulation of behavior provides a systematic conceptualization of the role that impulsive behavior plays in the development of the child, and in so doing provides a useful framework from which the problem of lower SES impulsivity may be viewed.

Luria (1961) makes a critical postulation with regard to the development of an individual's ability to control his own behavior in accordance with some understood verbalization. He maintains that there is a fundamental distinction between the processes basic to the management of the inhibition and initiation of responses. In a series of investigations involving a standard task in which the child was instructed to respond by squeezing (or refraining from squeezing) a rubber bulb in accordance with the onset of either of the two different stimulus lights, Luria obtained

results which appeared to support his position. Children between 2 and 5 years of age had consistently greater difficulties in withholding the bulb pressing response when this response was inappropriate (thus producing impulsive errors), than in initiating this response when it was appropriate. Replication of these demonstrations has been attempted by Miller, Shelton, and Flavell (1970), and Jarvis (1968). The children in these studies also appeared to have had the greatest difficulty when instructed to withhold their responses to the light signifying "Don't Press." Miller et. al. and Jarvis did not evaluate this difference statistically.

Luria proposed that this acquisition of impulse control is based on the fact that the child no longer responds to the initial instructions just in terms of their physical, stimulus nature. Rather, the older child is able to respond to the semantic intent of the instructions. He is therefore capable of appropriate behavior to the stimuli signifying "Don't Press." There appears to be support for this interpretation in the psycholinguistic literature. McNeill (1970) cited evidence which indicated early development is a period in which children often respond to verbalizations as though they were "occasions for action." This, McNeill stated, leads to difficulties in withholding responses.

Clearly, then, there is a great deal of evidence which suggests that children gain control over the ability to <u>initiate</u> behavior at an earlier age than that required for the control over the ability to <u>inhibit</u> behavior. On the other hand, this difference in the age at which control is attained for the two types of activities does not permit the generalization that initiation and inhibition of behavior involve different mechanisms. Both might involve the same basic processes, but the verbal discriminations involved in inhibitory behavior might simply be somewhat more difficult

for the child.

What type of evidence would be relevant to Luria's assumption that the ability to follow verbal instructions involves different processes when the instructions demand initiation of a response as opposed to when they demand its inhibition? One type of evidence would involve examination of individual differences in performance. Using this procedure, one might then determine whether initiatory and inhibitory behavior correlate together so highly that they appear to constitute a single factor of behavior, and thus stem from a single underlying process. On the other hand, it might be found that various conditions of initiatory behavior prove to be intercorrelated, and various conditions of inhibitory behavior also prove to be intercorrelated, but initiatory and inhibitory behavior are unrelated. In the latter case, the two independent factors would suggest that Luria is correct and different underlying processes are at work for the two types of behavior. In short, factor analysis would assist as in determining the number of basic processes involved in the verbal control of behavior.

If a basic distinction between initiatory and inhibitory tendencies can be shown, it would become realistic to investigate a second issue: The relationship between socioeconomic status (SES) and the development of verbal control over impulsive behavior. Evidence has indicated that lower SES children experience relatively great difficulties in language proficiency (Bernstein, 1962; Hess and Shipman, 1965), in communication abilities (Krauss and Rotter, 1968) and in verbal ability (John and Goldstein, 1967; Deutsch, 1968). The particular question remains, however, as to whether these difficulties are related to difficulties in the verbal control of behavior.

The third issue to be examined is the generality of an impulsive

disposition. It is important to know whether impulsive behavior reflected on the Luria task is correlated with impulsive behavior in the classroom and on other tests of impulsivity such as Kagan's (1964, 1965a, 1965b) Matching Familiar Figures test (MFF).

The fourth and final question involves a practical issue: Are problems in impulse control related to difficulties in the child's ability to profit from his classroom experience, or is impulsive behavior something that may irritate a teacher but does not necessarily lead to poorer grades and achievement? If impulsive behavior and classroom grades are, in fact, related, it is imperative to know if this relationship is independent of the child's IQ. There is evidence that some forms of behavior which have been described as impulsive do relate significantly with IQ (Maccoby, Dowley, Hagen, and Degerman 1965; Massari, Hayweiser and Meyer, 1969).

The present paper reports the results of two related studies. The primary purpose of the first study (involving both nursery and first grade Ss) was to determine what evidence there is of two distinct processes basic to the control over the initiation and inhibition of inappropriate behavior on the Luria task. In the second study the focus of interest was in the relationship between impulsive behavior and the child's success with the academic work presented in the first grade. Other than the fact that the interstimulus interval in the Luria task was shortened to increase the difficulty level to one more appropriate for the first graders, the inclusion of indices of school learning constituted the only departure from the procedure used in the first study. Hence the results of study 2 permits an important check on the reliability of the initial findings.

METHOD

Subjects

The Ss were 165 nursery school and first grade children drawn from Detroit and suburban area schools. In study 1, within the nursery school level, 15 white middle SES Ss were drawn from a suburban nursery while 18 black lower SES Ss were drawn from an inner city nursery. In the middle SES, 11 Ss were male and 4 female; while in the lower SES, 10 were male and 8 were female. At the first grade level all 45 Ss (23 middle and 22 lower SES black children) were drawn from the same four classrooms, in three schools which bordered the Detroit inner city. In the middle SES, 15 Ss were male and 8 female; while in the lower SES 11 were male and 11 were female. The split between SES classifications of these first grade Ss was made on the basis of their parents level of income (above or below $8,000) and their occupation (white or blue collar worker).

In study 2 the first grade sample included 45 white middle SES Ss from a school located in a middle SES suburb of Detroit, while 42 black lower SES Ss were drawn from a Detroit inner city school. In the middle SES, 24 Ss were male and 21 female; while in the lower SES 21 were male and 21 female.

Materials

The materials included in both phases of the experiment included:

Luria double light task. The display consisted of a blue and green 7.5 watt light bulb mounted in the position of the eyes of a clown whose face was painted on a white circular piece of plywood, 19 inches in diameter. A response button, requiring 1/4 of an inch depression for contact, served as the clown's nose. Controls for the stimuli were separate from the apparatus, enabling E to sit some distance from S during experimentation.

Housed on the same unit as the controls was a four-pen Rustrac even recorder permitting permanent recording of the Ss responses.

Peabody Picture Vocabulary Test (PPVT). The PPVT, consisting of a series of plates representing the vocabulary items on which the S is being tested, was administered as a basis for estimating the child's verbal IQ.

Kagan's Matching Familiar Figures Test (MFF). The younger child's version of the MFF test consists of a series of standard pictures along with four pictures for each standard, three of which are variants of the standard. The S is instructed to pick out from among the variants the picture which is identical to the standard. The time taken to make the first choice and the average number of errors committed on each standard are scored by the E. Kagan et. al. (1964, 1965a, 1965b) holds that individuals who respond relatively quickly on their first choice for each standard and who also tend to have a higher number of errors are more impulsive than those individuals who have slower reaction times and a lower number of errors. With respect to these differences Kagan (1964) has reported that they reflect a more general tendency (cognitive style) for some children to reflect over alternative solution possibilities in situations involving high response uncertainty, in contrast with others for whom there is a tendency to make quick, impulsive responses in these situations.

Teacher questionnaire. This consisted of eight statements which focused on the topic of difficulties in impulse control observed by teachers in their classrooms. Items selected were chosen so as to have maximum face validity. Each of the children tested was rated on the general issue of classroom impulse control by means of their teachers indicating on a six-point scale whether they strongly agreed or strongly disagreed

with the following statements: "(1) This individual has difficulty following instructions; (2) This individual could be considered a behavior problem; (3) This individual has difficulty listening to directions; (4) This individual shows little tolerance for frustrating situations; (5) This individual shows difficulties in self-control; (6) This individual has difficulty completing any task he (or she) starts; (7) This individual has difficulty stopping most kinds of activity when told to do so; (8) This individual has difficulty sitting still most of the time." Individuals obtaining relatively high scores were considered more generally impulsive in the classroom.

In the second study, grades for the first grade Ss were obtained. Teachers were asked to rate the S's schoolwork on a four-point scale: 4--very good; 3--good; 2--fair; 1--poor. It was hoped that a four-point scale would provide enough variance to allow meaningful distinctions between Ss, while on the other hand being similar enough to the teachers' own grading scale to provide a reliable score. Stanford Achievement Scores were also available for the lower SES sample, thus permitting their inclusion in the analysis. The scores of one of the individuals were not available.

Procedure

Each S was tested individually. At the start of the session the children were tested on the PPVT. The PPVT was presented as a "picture game." Since S had no way of knowing for certain whether he was making a mistake (on the PPVT), it was hoped that this test might minimize the child's uneasiness in the experimental situation. Following this, the Luria task was administered. The Luria task was also presented to the child as a game in which E stated that he was going to see whether S could press the

clown's nose when his blue eye lit up, but not press when his green eye lit up. The game was played under the following three conditions: First, a non-verbal condition in which S responded silently. Second, an intervening verbal condition in which S was instructed to verbally accompany his responses to the appropriate lights by saying "press" or "don't press." Following this, a second non-verbal condition was administered in which S was again instructed to respond silently.

In each condition the two stimulus lights were randomly presented in a series of 48 trials. There were 24 trials for each of the lights. In study one each trial consisted of an approximate .5 second presentation of the stimulus followed by an interstimulus interval ranging from 2 to 2.5 seconds. An interval of this length was used in the first study in order to insure that all Ss had enough time to both observe and respond to the stimulus lights. After preliminary instructions were given, E had each S carry out ten practice trials for each condition in order to ascertain whether S understood the task. In the few situations where S could not, preliminary instructions were given again. Following the Luria task, the MFF test was administered to the child, after which the child was informed that there were no more games to be played. Teacher ratings were collected after the administration of the foregoing task.

In the second study, the procedure was the same as that of the first, with the exception of a decreased interstimulus interval. Pilot work with a 1 to 1.5 second interstimulus interval indicated that this produced a more appropriate level of difficulty for the first graders. In addition to teacher ratings of impulsivity, a rating of each S's grade in school was also obtained after completion of testing.

Experimental Analysis

Luria task errors were scored as either one of two distinct types. Omission errors were recorded when the S failed to perform the press response during the trials which began with the onset of the stimulus light signifying "Press," and terminated with the onset of the light signifying the beginning of the next trial. Impulsive errors were recorded when the S failed to withhold the press response during those trials which began with the onset of the light signifying "Don't Press," and terminated with the onset of the light signifying the beginning of the next trial. Therefore, impulsive and omission errors were experimentally independent. There were three conditions in the Luria task: (a) the first non-verbal condition (NV1), (b) the verbal condition (V) in which Ss were instructed to verbalize "press" or "don't press" before making the appropriate motor response, and (c) the second non-verbal condition (NV2). Each of these conditions permitted calculation of both impulsive errors and omission errors.

Correlation matrices, containing Pearson product moment correlations, were generated on the basis of the errors committed on the six observations made on the Luria "Press" and "Don't Press" tasks, along with the other measures included in this study.[1] Factor matrices were derived using the method of principle axis determination, and rotated in accordance with the Varimax criterion. Only those factors having unrotated eigenvalues greater than 1.00 were included in the rotation.

RESULTS

Analyses of Score Means

As has already been pointed out, the issues of major concern in this paper are not readily solvable by analyses of the differences between means of impulsive and omission errors for the various SES and age conditions. However, there are some informative aspects of these data and thus they are presented in Table 1. Let us first consider performance on the Luria

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Insert Table 1 about here

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subtasks. Since the three Luria subtasks that measured impulsive errors often proved to be very highly intercorrelated, as were the three subtasks that measured omission errors, the data for these subtasks were summed to obtain the means presented in Table 1. Note that with the rates of presentation used in the nursery group in study 1 and in the first grade group in study 2, lower SES children made more of both types of errors, on the Luria task, than did the middle SES. In both groups these SES effects were statistically significant, F (1,27) = 5.9, $p < .01$, and F (1,85) = 23.1, $p < .01$, respectively. The lack of such a difference between SES levels on the Luria task for the first graders of study 1 is due to the fact (noted in the procedure section) that the interstimulus interval used in study 1 was relatively long for these older children, and they made very few errors. (It will be seen later that, despite this small number of errors, the factor structure for this group proved to be very similar to that of the first graders of study 2, where a more appropriate interstimulus interval led to a larger number of errors.)

While we see that the lower SES groups make more errors than the

middle SES on the Luria tasks, it is not clear from Table 1 that these lower SES children have a particular problem with impulsive errors as opposed to omission errors. The analyses of variance of these data indicated that none of the interactions between SES and type of error approach statistical significance. However, the analyses of the next section shall show that these conclusions, based on the means of errors, are not completely justified. While the lower SES children, as a group, make approximately as many omission errors as impulsive errors, the tendency to make either of these two types of errors proved to be independent. The child who makes many impulsive errors does not necessarily make many omission errors. Further, it will be seen that the tendency to make impulsive errors on the Luria tasks was diagnostic of scholastic difficulties, while the tendency toward omission errors was not.

Turning briefly to the other variables summarized in Table 1, it is interesting to note that response time means on the MFF test were not related to either SES or grade level. An analysis of variance conducted on the reaction time scores showed that the effect of SES and grade level did not approach significance. On the other hand, mean errors on the MFF test were greater for the lower SES groups than for the middle SES; however, only the difference at the first grade in study 2 was significant, t (85) = 3.04, $p < .01$. Also, the first graders made fewer errors than the nursery children.

The teacher ratings of impulsivity show that the lower SES children were rated more impulsive in class than the middle SES at each of the three comparisons; however, this difference was statistically significant only for the first graders of study 1, t (43) = 2.86, $p < .01$.

As might be expected, differences in intellectual ability measured by

verbal IQ were all highly significant (beyond the .01 level by t test) and in favor of the middle SES.

Study 1

Nursery School

Factor matrices based on the data from the middle and lower SES children of study 1 are presented in Table 2a and 2b. In the middle SES the eigenvalues for the first three unrotated factors were 2.9684, 2.3716, and 1.4710. In the lower SES the corresponding values were 2.9701, 1.4319, and 1.1876.

Insert Table 2 about here

Impulsive and omission errors. Factor 1 for each SES was characterized by high loadings from the impulsive errors committed in all three phases of the Luria "Don't Press" task. These loadings reflected significant correlation coefficients ($p < .05$) between the impulsive errors in these conditions, with values ranging from $r = .72$ to $r = .90$. On the other hand, the omission error loadings were negligible on Factor 1.

Conversely, impulsive errors did not produce any loadings on factors on which omission error loadings appeared (note Factor 2 in the middle SES, Table 2a, and Factors 2 and 3 in the lower SES, Table 2b). Thus in the nursery school the production of impulsive and omission errors led to clearly distinguishable, orthogonal factors in both the lower and middle SES samples. It should be pointed out that verbal IQ as measured by the PPVT failed to yield loadings on the Lurian impulsivity factors in either SES. Not entirely unexpected, the sex of the subject, entered as a

dichotomous variable, loaded on the impulsivity factor in both groups. Boys were more impulsive than girls.

Comparison of impulsive indices. In going beyond the pattern of omission and impulsive error loadings, some divergence appeared in the structure of the matrices for lower and middle SES. In the middle SES (Table 2a), observe that the scores from Kagan's MFF test of impulsivity appeared in Factor 3. Since the MFF impulsivity and Luria impulsivity loaded on different factors for the middle SES children, it appears that they are independent variables for these Ss. Apparently, Factor 3 reflects an independent "cognitive style" variable, thus replicating those results obtained by Kagan (1964, 1965a, 1965b).

The structure present in the lower SES (Table 2b) stands in striking contrast to that of the middle SES. In the lower SES there was no evidence of a discrete factor indicating an impulsive cognitive style. Rather, the MFF response-times score produced a relatively high negative loading on Factor 1 along with impulsive errors on the Luria task. Thus Lurian impulsive errors were associated with shorter response-times on the MFF.

Hence, it appears that impulsive behavior in the middle SES can be manifested in either one of two distinct, unrelated forms: that of Luria task impulsivity, or that of an impulsive cognitive style. In the lower SES there was no evidence of a distinct cognitive style of impulsive behavior.

The teacher ratings of classroom impulsivity produced a substantial loading on the Luria impulsivity factor in the middle SES (Factor 1, Table 2a). This indicates that impulsivity in the classroom is related to Lurian impulsivity. On the other hand, classroom impulsivity in the lower SES loaded on Factor 2 (Table 2b). Thus in the lower SES, impulsivity in the classroom did not appear to be strongly related to either Luria task

impulsivity or to that measured by the MFF.

First Grade

The middle and lower SES factor matrices for first graders in study 1 are presented in Tables 3a and 3b. In the middle SES the eigenvalues for the first three unrotated factors were 3.0696, 1.7309, and 1.0677. In the lower SES the corresponding values were 2.7627, 1.3598, and 1.0762.

Insert Table 3 about here

Impulsive and Omission Errors. Examination of the lower SES factor matrix presented in Table 3b reveals a pattern of loadings which is quite similar to that found in both nursery school factor matrices (Table 2). In the lower SES notably high loadings for impulsive errors on all conditions on the "Don't Press" Luria task occurred on the first factor; these loadings reflected significant correlations between these conditions ($p < .05$) ranging from $r = .49$ to $r = .73$. Loadings for omission errors were minimal on Factor 1. In a fashion reminiscent of the lower SES nursery children, omission errors (Table 3b) loaded predominately on two factors (Factors 3 and 4).

For the lower SES first graders, as in the nursery, verbal IQ had little relationship with Lurian impulsivity factor. Unlike the nursery group, sex was not strongly related to impulsivity.

In turning to the factor matrix for the middle SES children (Table 3a) it can be seen that the pattern of impulsive and omission errors is substantially different than that found in all previous matrices. Factor 1 was defined by very high loadings from both omission and impulsive errors in the last non-verbal condition of the task. Impulsive errors from NV1 and

and V loaded on Factor 2, but impulsive errors from NV2 did not. The absence of a loading from NV2 suggests an impulsivity factor which may be viewed as a residual of the one observed in the nursery. Moreover this "residual" impulsivity factor was contaminated by the presence of omission error loadings from two response conditions. (It will be seen in study 2 that this residual factor fails to occur with the larger sample employed.) Hence these factor loadings did not present a pattern indicating a discrete Lurian impulsivity factor in the form that it has been previously observed. We see instead what appears to be only a residual of the impulsivity factor seen in the nursery, and a notable tendency towards the merging of the impulsive and omission error factors.

Comparison of Impulsivity Indices. Recall that in the nursery school, middle SES children showed different factors for Lurian and Kagan impulsivity. In first grade this separation persisted. Thus if Factor 2 (Table 3a) reflects the "residual" element of Lurian impulsivity remaining at this age, this residual is independent of MFF impulsivity. The MFF errors loaded only on Factor 1 along with both types of Luria task errors. The structure presented by the pattern of Luria task impulsivity loadings on Factor 2 coupled with the absence of MFF loadings, indicates that the behavior measured by the two tasks is independent in the middle SES.

In contrast to this picture, the lower SES factor matrix (Table 3b) is similar to that of the lower SES nursery children. There was again evidence that Lurian and Kagan task impulsivity were related. Here the only loadings of noticeable magnitude on Factor 1 (apart from Lurian impulsive errors) were from MFF response times. It should also be noted that these were the largest MFF response time loadings in the matrix.

To summarize, some consistency therefore did appear across age, even

though the structure of loadings for the Luria and MFF task in the first grade samples was not the unequivocal one presented in the nursery.

The teacher ratings of impulsive behavior in the lower SES (Table 3b) yielded notable positive loadings on Factor 3 along with Lurian impulsive errors and intelligence. Note that Lurian omission errors loaded negatively on this factor.

Study 2

Recall that other than the inclusion of indices of academic performance and the decrease in interstimulus interval in the Luria tasks, the measures used in this phase were identical to those just discussed. The effect of the decreased interstimulus interval in the Luria task was to increase the production of errors to a level comparable to the nursery.

The middle and lower SES factor matrices are presented in Table 4a and 4b. In the middle SES the eigenvalues for the first two unrotated factors were 2.1362 and 1.2009. In the lower SES the eigenvalues for the first three unrotated factors were 3.1556, 1.6062, and 1.0054.

Insert Table 4 about here

Impulsive and Omission Errors. The factor structures for the first grade samples of study 2 (Table 4) were quite similar to those obtained in the first grade in study 1. For the lower SES matrix (Table 4b), it can be seen that Factor 1 was characterized by high impulsive error loadings from all three conditions of response and negligible loadings from omission errors. Omission errors, on the other hand, loaded substantially on Factor 3, where there are negligible loadings from impulsive errors. It is crucial to note

that there was no evidence of any overlap or merging of any of the factors representing impulsive and omission errors, as in the case of the middle SES.

In the middle SES factor matrix (Table 4a), loadings from both omission and impulsive errors again fell on the first factor, as occurred in study 1. In looking further it can be seen that loadings from the remaining impulsive and omission error conditions defined Factor 2, thus indicating substantial overlap between errors on the two tasks.

The data in both studies are quite consistent in indicating that the processes basic to the generation of omission and impulsive errors were unequivocally independent of each other only for those first graders who were from the lower SES.

It should be mentioned that verbal IQ failed to load on the Lurian impulsivity factor in the lower SES (Factor 1, Table 4b). Further, the subject's sex did produce a measurable loading along with Lurian impulsive behavior in the lower SES.

Comparison of Impulsive Indices. In the lower SES (Table 4b) it can be seen that the Lurian impulsivity factor (Factor 1) was further characterized by a high loading from errors on the Kagan MFF test. This loading reflected relatively strong and significant correlations between MFF errors and Lurian impulsive errors in all three conditions of response. The values ranged from $r = .36$ to $r = .59$.

Interestingly enough this pattern did not occur in the middle SES. Here, MFF errors loaded only on Factor 1 along with both omission and impulsive errors. Thus for the middle SES first graders in both studies, there was no evidence of the combined Lurian impulsive and MFF error factor.

The teacher ratings produced predominant loadings on those factors

containing loadings from classroom grades: Factor 2 (Table 4b) in the lower SES, and Factor 1 (Table 4a) in the middle SES. Note, however, that it was only in the case of the lower SES that impulsive error loadings were represented along with teacher ratings without the presence of omission error loadings. In the middle SES there were no significant correlations between Luria task impulsive errors and the teacher ratings.

Impulsivity, Classroom Grades, and IQ. Recall that a question of central interest was that of the relationship between impulsive behavior and that of grades in school; viz., is difficulty with impulse control a predictor of poor grades in school? Looking initially at the first grade matrix in the lower SES (Table 4b), it can be seen that the highest loadings from grades occurred on Factor 2, along with teacher ratings and verbal IQ (i.e., teacher ratings which indicated greater impulsivity were associated with low IQ and poorer grades). However, grades also loaded on Factor 1 with Luria task impulsive errors (i.e., high impulsive errors with poorer grades), with no loadings from IQ. This pattern reflected significant correlations between grades and Lurian impulsive errors for both non-verbal Lurian tasks (r's approximately - .40), while the correlation with the verbal condition (r = -.27) approached significance. Turning briefly to the middle SES children for purposes of comparison, there was no indication of a relationship between grades and a Luria task impulsivity factor. Moreover, there were no significant correlations between grades and the Luria task in the correlation matrix. Thus only in the lower SES did grades comprise a significant part of the Lurian impulsivity factor.

One interesting aspect of the relationship between Luria task impulsivity and grades in the lower SES were the essentially zero loadings from Peabody IQ on Factor 1 (Table 4b). This structure was reflected in

the correlation matrix for impulsivity scores, but not for MFF errors. The correlations between the Luria task and PPVT were not significant, ranging from r = -.14 (V) to r = -.22 (NV1). The correlation between MFF errors and IQ was significant, r = -.35 ($p < .05$).

The correlation between classroom grades and Lurian impulsive errors, using a pooled score over all three Luria tasks was r = -.43 ($p < .05$). An even more objective index of school performance was obtained in the form of Stanford Achievement scores. Two of the three subtests administered to all children correlated significantly ($p < .05$) with impulsivity as measured by the pooled Luria task errors: Word Reading (r = -.43) and Arithmetic (r = -.33). Thus, lower impulsive errors were associated with higher achievement scores. The remaining correlation, between impulsivity and Vocabulary (r = -.22), was not significant and was in the range expected from the obtained correlations between impulsive errors and PPVT scores (i.e., from a low of r = -.14 to a high of r = -.22). Interestingly neither of the two measures of the MFF impulsivity test correlated significantly with any of the Stanford scores. The Peabody IQ scores, however, related significantly ($p < .05$) to each of the Stanford subtests, i.e., PPVT with Word Reading (r = .42), with Vocabulary (r = .59), and with Arithmetic (r = .63). Since IQ related so strongly to the achievement test scores, it was important to determine more precisely to what extent it influenced the Luria task impulsivity, achievement score relationship.

Using the Ss' pooled Luria task impulsivity scores, the lower SES Ss were divided at the median into low ($\bar{X}$ = 1.0) and high ($\bar{X}$ = 11.5) impulsive error groups; these groups were then compared on classroom grades and Stanford Achievement scores. Classroom grades of the high impulsive group were significantly poorer than those of the low impulsive group, F (1,40) =

11.5, $p < .01$. The average grade for the high impulsive Ss was 2.1 (where 4 was the best possible grade and 1 the poorest), while the average grade for the low impulsive Ss was 3.1. On the Stanford Achievement Test, the high impulsive Ss scored significantly more poorly than the low impulsive on both Word Reading and Arithmetic, F (1,39) = 14.8, $p < .01$ and F (1,39) = 9.2, $p < .01$, respectively. In converting these scores to grade level equivalents, low impulsive Ss performance was found to be approximately at grade level, whereas the high impulsive Ss were approximately one-half year behind. Since these tests were administered at the end of the first year of school, it can be appreciated that a one-half year lag is relatively very great.

Differences between the IQ's of the two impulsivity groups were also significant , F (1,39) = 4.7, $p < .05$. In order to determine the role of verbal intelligence in these differences, analyses of covariance were performed on the data using the Ss Peabody IQ score as a covariate. With the effect of IQ removed, the differences between the means of both groups remained significant on all academic indices. The relevant values were F (1,39) = 6.6, $p < .01$ for grades; F (1,38) = 9.0, $p < .01$ for Word Reading; and F (1,38) = 4.2, $p < .05$ for Arithmetic. In short, it appears that high impulsive, lower SES children are having substantial difficulties in school related academic work, irrespective of their intellectual ability.

DISCUSSION

The present study was designed to give us a more complete understanding of the mechanisms involved in impulsive behavior and to explore the relationship between development of impulse control and socioeconomic class. In returning to the questions posed in the introduction, four major points can

be made. First, in the nursery school the processes basic to the production of impulsive and omission errors on the Luria task were always represented by two different factors, irrespective of the SES of the child. In first grade there was some tendency towards the merging of the impulsive and omission error factors, indicating a developmental attenuation of the importance of the impulsivity factor. Secord, the data were consistent in indicating that distinct impulse control problems on the Luria task persist longer in the development of the lower SES child than the child of middle SES. Third, the evidence consistently indicated that impulsive behavior is a more general phenomenon in the lower SES than in the middle SES. There is also reason to believe that this general control problem, in the lower SES, was related to the sorts of impulsive behavior observed by their teachers in the classroom. Fourth, when intelligence was controlled, lower SES Ss obtained significantly poorer classroom grades and Stanford Achievement scores. There was no evidence of this relationship between Luria task impulsivity and grades in the middle SES.

Previous studies (Jarvis, 1968; Luria, 1961; Miller, et. al., 1970) have shown that ability to correctly initiate behavior is acquired earlier than the ability to correctly inhibit responses. Data of this sort are ambiguous with regard to the issue of whether or not two different sets of mechanisms must be postulated. Inhibition of response could conceivably involve the same mechanisms as initiation of response, but particular task requirements (e.g., the time permitted for response) might make inhibition more difficult. The data of the present experiments were more conclusive on this issue. The factor structure for nursery school children clearly showed an orthogonal relationship between impulsive errors and omission errors. This finding is particularly critical in Study I since with the

interstimulus interval used in this study, the two types of errors occurred with approximately equal frequency. Therefore, the two orthogonal factors cannot be attributed to differences in difficulty level.

The orthogonal relationship between these types of errors suggests that Luria may have been correct in his analysis of the control of behavior with regard to its initiation and inhibition. Further evidence for Luria's position, regarding the development of discrete control processes, was seen in the merging of impulsive and omission error factors in middle SES children by the time they reached first grade. If the inability to respond to the semantic content of the instructions is basic to impulsive responses in the young child, then as the child acquires the capability of responding to the semantic inhibitory content, evidence for discrete problems in the impulse control mechanism should diminish.

The present data suggest that the development of control over impulsive errors on the Luria task proceeds more slowly in the lower than in the middle SES. For the lower SES children there was a striking similarity between the factor structures obtained in nursery school and in first grade. At both grade levels, the Lurian impulsivity scores defined a single, unique factor.

In contrast, for the middle SES children there was a marked change in the patterning of impulsive error loadings, between nursery school and first grade. By first grade the unique impulsivity factor had disappeared and a relatively stable general error factor appeared which included both impulsive and omission errors.

It should be mentioned here that the data in the present study suggests that the overriding variable in the group differences is the child's SES and not race. Recall that one of the middle class matrices (Study 1) was generated

on the basis of data collected from Black middle SES children while the other (Study 2) involved middle SES children who were White. Yet in both cases there was evidence of a breakdown in the unitary nature of the impulsivity factor. Moreover, in the nursery similar problems in the control of impulsive behavior were found to be in evidence in both races irrespective of the SES of the children.

Another striking feature of the data lies in the contrast between the impulsive behavior indexed by the Luria and MFF task. Kagan conceptualizes the MFF test as a measure of a cognitive style; the Luria task, on the other hand, appears to tap a more basic ability to control impulsive behavior. Two contrasting pictures of the relations between Ss responses to these tasks are observed depending upon the SES in question.

In the middle SES, impulsive behavior measured by the Luria and MFF task was always represented by different factors of behavior. This picture was quite clear in the nursery, where Kagan's cognitive style appeared as one discrete factor, and the Lurian impulsive errors appeared as another. In contrast, in the lower SES there was no evidence, at either grade level, of two distinct factors of impulsive behavior. The data were consistent in showing that one of the scores of the MFF test was always represented on the Lurian impulsivity factor. The implication appears to be that in the lower SES we are dealing with a more basic behavioral control ability rather than one based upon a preferred cognitive style.

With regard to the practical issue of the relationships between impulsive behavior and academic work, the evidence is straight-forward. For lower SES children, the effect of high Luria task impulsivity was lower grades and poorer achievement scores. This effect cannot be accounted for on the basis of the childrens' IQ's. Since the ability to control impulsive

behavior relates to achievement on arithmetic and reading skills, as well as class work in general, it is strongly suggested that verbal control problems do in fact impede scholastic development.

One could, of course, argue that it is difficult to impute the causal direction of these obtained relationships. Thus, it might be contended that these children who experience failure in their efforts to achieve begin to behave impulsively or "act out" as a consequence of their "frustration" or "anger" at failure. While one cannot say definitely that this is not the case, the evidence suggests that this is quite unlikely. If academic failure in the lower SES was the mechanism basic to impulse control problems on the Luria task, then we should not expect to find a factor reflecting impulse control problems in the nursery. That this factor appeared in both lower and middle SES nursery classes suggests that its genesis is not related to scholastic failure since these situations preceded academic failure.

In conclusion, the practical significance of the Lurian impulsivity factor in the lower SES lies, in part, with the ties which exist between it and impulsive behavior in the classroom. But even more crucial than this is its relationship to grades and school achievement. Having strong evidence of the contribution of poor verbal impulse control to the lower SES child's educational achievement, one is now better able to select a type of compensatory training which is relevant to the features of this particular type of impulse control problem.

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Table 1

Group means on measures included in both studies

GROUPS	Luria Task Errors		MFF		Teacher Ratings	IQ
	Impulsive	Omission	Rt	E		
Nursery:						
Middle SES (N=15)	3.1	3.6	5.04	6.13	1.84	122.4
Lower SES (N=18)	8.4	5.6	5.16	8.55	2.36	86.9
Study 1, First Grade:						
Middle SES (N=23)	0.9	0.9	5.66	1.56	2.64	106.8
Lower SES (N=22)	1.0	1.4	6.04	1.95	3.64	88.1
Study 2, First Grade						
Middle SES (N=45)	1.8	3.9	5.11	1.84	2.21	107.3
Lower SES (N=42)	6.2	7.4	5.40	3.33	3.11	88.8

Table 2

Nursery School: Varimax Factor Loading Matrices

for the Middle- and Lower- SES Subjects

TASK	FACTORS					
	(a) Middle SES			(b) Lower SES		
	1	2	3	1	2	3
Impulsive Errors (NV1)	0.9091	0.0209	0.2410	0.8496	-0.0839	-0.1328
Impulsive Errors (V)	0.7652	0.0485	0.1400	0.8928	0.0392	-0.0333
Impulsive Errors (NV2)	0.9621	-0.1871	0.0457	0.8797	-0.0440	0.0455
Omission Errors (NV1)	-0.0489	0.9105	0.0969	-0.0907	0.8168	0.0689
Omission Errors (V)	-0.0389	0.6095	0.3850	0.0052	-0.2187	0.5916
Omission Errors (NV2)	0.1502	0.8253	0.1345	-0.0896	-0.0422	0.4614
Kagan MFF (Rt)	-0.0740	-0.0688	0.7328	-0.3988	-0.3090	-0.3722
Kagan MFF (E)	-0.1102	0.6054	-0.5179	0.1775	-0.0057	-0.1098
Teacher Rating	0.5241	-0.1072	-0.3800	0.0920	0.6995	-0.1087
PPVT	0.0010	-0.0951	0.0491	0.1691	-0.2262	-0.5092
Sex	-0.5339	-0.1731	0.2041	-0.4924	-0.2833	0.2221
Total variance accounts for	26.5%	21.6%	13.3%	25.7%	13.1%	10.6%

Table 3

Study One, First Grade: Varimax Factor Loading Matrices

for the Middle- and Lower- SES Subjects

TASKS	FACTORS					
	(a) Middle SES			(b) Lower SES		
	1	2	3	1	2	3
Impulsive Errors (NV1)	0.0963	0.5081	-0.0892	0.8277	-0.3456	0.1033
Impulsive Errors (V)	0.2670	0.7869	0.1278	0.6511	-0.4259	0.4411
Impulsive Errors (NV2)	0.8868	0.0310	-0.3439	0.7968	0.1816	0.0233
Omission Errors (NV1)	0.4753	0.4450	0.4321	0.2758	0.1224	-0.5619
Omission Errors (V)	0.1295	0.3749	-0.1203	0.0933	-0.4133	0.0190
Omission Errors (NV2)	0.9119	-0.0340	-0.1429	0.2298	-0.6131	0.2333
Kagan MFF (Rt)	0.0218	-0.1271	-0.0467	0.3329	-0.0386	-0.1584
Kagan MFF (E)	0.7605	0.1607	0.0083	-0.0610	-0.3493	-0.0099
Teacher Rating	-0.2331	0.3473	0.1117	0.0868	-0.3901	0.6054
PPVT	0.2369	0.5027	-0.5089	-0.1232	0.5221	0.4627
Sex	0.3580	-0.5528	0.2580	-0.0127	0.6755	0.0092
Total variance accounts for	25.4%	15.2%	10.2%	18.5%	12.3%	11.6%

Table 4

Study Two, First Grade: Varimax Factor Loading Matrices

for the Middle- and Lower- SES Subjects

TASKS	FACTORS				
	(a) Middle SES		(b) Lower SES		
	1	2	1	2	3
Impulsive Errors (NV1)	-0.4785	-0.2354	0.8801	-0.1944	-0.0441
Impulsive Errors (V)	0.0561	-0.4500	0.8018	0.0330	0.0495
Impulsive Errors (NV2)	0.0091	-0.4728	0.4942	-0.3787	-0.1375
Omission Errors (NV1)	0.0607	0.5470	-0.0844	-0.1873	0.6906
Omission Errors (V)	-0.5128	0.2412	0.0640	-0.0351	0.6927
Omission Errors (NV2)	0.0572	0.7509	-0.1001	0.0987	0.6355
Kagan MFF (Rt)	0.0366	-0.1629	-0.1197	0.1415	-0.1045
Kagan MFF (E)	-0.5873	0.0348	0.5878	-0.4177	0.0251
Teacher Rating	-0.7164	0.0789	0.1498	-0.7089	0.2336
PPVT	0.0762	-0.1870	-0.0997	-0.6605	0.1302
Sex	0.3504	0.3502	-0.3032	0.2511	0.1414
Classroom Grades	0.8484	-0.1807	-0.2569	0.6955	0.0163
Total variance accounts for	18.5%	13.4%	26.3%	13.4%	8.4%